

engineering. He expressed the opinion that in the teaching of those who have to work during the day and have only the evening in which to study, Great Britain is making progress. In many departments of technical education there is still much to learn, but in classes such as those in polytechnics England has led the way. The full value of such studies is often not attained, said Sir William White, because of the absence of a scientific method of teaching. Some teachers are uninformed themselves, and the consequences are serious to their students. The want of a good English elementary education has been recognised, but in secondary education there is much which still remains undone. He advised every student of engineering to apply himself to the study of mathematics and applied mechanics, without which an engineer must be at a disadvantage and have to work in the dark.

REFERENCE was made last week (p. 286) to the grant of 400*l.* a year, for the next five years, voted by the Drapers' Company for work in the department of applied mathematics at University College, London. The company has long taken an active part in the development of higher education, and the enlightened policy which has prompted it to make grants in aid of university work and scientific research in London will, we trust, be adopted by other city companies. No better testimony to the value of such grants could be obtained than is afforded by the memoirs which have been published containing the results of work carried on in Prof. Karl Pearson's laboratory (see, for instance, a note in NATURE of November 3, 1904, p. 15). In acknowledgment of the assistance given by the Drapers' Company to work of this kind, the council of University College passed the following resolution at its last meeting:—"That the council desire to convey to the Court of the Worshipful Company of Drapers their best thanks for the vote of 200*l.* towards further assisting the statistical work and higher teaching of the department of applied mathematics at University College. By their original grant of 100*l.* for this purpose the court has enabled the council to appoint an adequate staff and to purchase valuable apparatus for the work of the department. By generously continuing their aid the court will enable the work thus begun to be placed upon a more permanent footing, and will prepare the way for the establishment of a permanent statistical institute."

A RETURN showing the amount spent on technical education by local authorities in England and Wales—with the exception of four which have made no return—during the year 1902-3, has been prepared by the Board of Education and issued as a Blue-book. The return shows that the total amount of the residue received under the Local Taxation (Customs and Excise) Act, by the councils of counties and county boroughs in England (excepting the county of Monmouth), in 1902-3 was 879,405*l.*, of which 840,253*l.* was appropriated to educational purposes, and 39,152*l.* to relief of rates, the latter sum including 22,366*l.* devoted by the London County Council to relief of rates. Of the 49 county councils, 45 were applying the whole of the residue to technical education, and 3 a part of it to the same purpose. Of the councils of the 64 county boroughs, 61 were devoting the whole, and 3 a part of the residue to technical education. Further, 4 county councils and the councils of 31 county boroughs, 101 boroughs, and 211 urban districts, in England, were making grants out of the rates under the Technical Instruction Acts; and 31 local authorities were devoting funds to technical education out of the rate levied under the Public Libraries and Museums Acts. Thirty-three local authorities raised sums by loan on the security of the local rate under the Technical Instruction Acts. The total amount expended on technical education during the year was 1,149,216*l.* The total amount of the residue paid to the 13 county councils and the councils of the 3 county boroughs in Wales and Monmouth was 42,201*l.* These local authorities devoted the whole of it to intermediate and technical education, chiefly under the Welsh Intermediate Education Act, 1889. The total amount expended on technical education in Wales and Monmouth under the Technical Instruction Acts during the year was 42,781*l.*

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SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, January 4.—Dr. J. E. Marr, F.R.S., president, in the chair.—The marine beds in the Coal-measures of North Staffordshire: J. T. Stobbs, with notes on their palæontology by Dr. Wheelton Hind. The stratigraphical position of the marine beds can be located with exactness *in situ*. The horizons can be utilised for the subdivision of the Coal-measures. The known horizons at which marine fossils have been obtained were enumerated, and a map of the distribution of these beds was given. The Speedwell and Nettlebank bed appears to be the most important marine bed in the coal-field. A detailed table of the beds in North Staffordshire was given to show the exact position of the marine beds. Dr. Hind, in his notes on the palæontology, remarked that from the base of the Pendleside series to the top of the Coal-measures there is an unbroken succession of beds—at one time marine, at another estuarine, without unconformity.—The geology of Cyprus: C. V. Bellamy, with contributions by A. J. Jukes-Browne. The Kyrenia Mountains rise to heights of more than 3000 feet. They are composed of rocks tilted into a vertical position, altered by compression and intrusion, and are devoid of fossils. They are referred by Prof. Gaudry to the Cretaceous period, and are compared by him with the hippurite-limestones of Attica. The Kythraean rocks (Upper Eocene) are based on breccias and conglomerates made up of fragments of the Trypanian limestones. No fossils, except a few small tests of Globigerina, have been found in this series, which consists entirely of volcanic débris. The Idalian (Oligocene) series appears to rest conformably on the last. The gypsum-beds are largely developed in the south; the white chalky marls and limestones extend over nearly one-half of the island, and are always conspicuous from their intense whiteness. Foraminifera are abundant, and other fossils have been found which indicate that the beds are mainly of Oligocene age. Igneous rocks are most conspicuous in the centre of the island. They are intrusive into the formations already mentioned. The rocks include augite-syenite, rhyolite, liparite, olivine-dolerite, basalt, augite, and several varieties of serpentine. Miocene rocks have only been recognised in the south-east of the island. The Pliocene strata lie in horizontal or slightly inclined beds, resting unconformably upon all older rocks. The Pleistocene rocks sometimes attain a thickness of 50 feet. The cave-earths have yielded *Hippopotamus minutus* and *Elephas Cypriotes* to Miss D. M. Bate. An account of the chief economic mineral products of the island is given. Descriptions of some of the rocks, a note on the Miocene rocks, and a sketch of the physical history of the island are contributed by Mr. Jukes-Browne.

Mathematical Society, January 12.—Prof. A. R. Forsyth, president, in the chair.—Basic generalisations of well known analytic functions: Rev. F. H. Jackson. Recent investigations have led to generalised forms of the serial expressions of certain functions. The functional characters of the new series, the domains of convergence, and the possibility of finding linear differential equations satisfied by the generalised functions are the matters that next claim attention. The author explained the degree of success which he had attained in these lines of investigation.—Current flow in rectangular conductors: H. Fletcher Moulton. The paper deals with the resistance of a rectangular lamina between electrodes which occupy portions of opposite sides, and the distribution of currents which flow in a conducting lamina bounded internally and externally by squares.—On the kinematics and dynamics of a granular medium in normal piling: J. H. Jeans. The paper is occupied with problems suggested by Prof. O. Reynolds's "Sub-mechanics of the Universe." An attempt is made to examine the question of the permanence or non-permanence of peculiarities of piling such as Prof. Reynolds interpreted as matter, electricity, magnetism, &c. The results go to show that such peculiarities would be transient, and that a universe constructed as imagined by Prof. Reynolds would suffer instant dissolution, after which particles of matter, charges of electricity, &c., would

appear fortuitously at rare intervals, and have no continuous existence either in time or space. If the æther were a granular medium in normal piling, it would be ælotropic with eighteen elastic constants, and the velocity of propagation of waves of high frequency would be much greater than that of waves of low frequency. Light transmitted from distant stars would consist largely of mirages and coloured spectra.—On a class of expansions in oscillating functions: Prof. A. C. **Dixon**. The paper deals with expansions of the kind discussed by Liouville and Sturm in which arbitrary functions are expanded in series of special functions which satisfy differential equations of a certain type. These expansions are used frequently in applications of mathematics to physics. The object of the paper is to give a rigorous proof of the possibility of such expansions in the case of functions which are analytic throughout the proposed range of validity of the expansions.—Generational relations for the abstract group simply isomorphic with the group $LF[2, p^n]$: Dr. W. H. **Bussey**.—On alternants and continuous groups: Dr. H. F. **Baker**. The paper is occupied with the proof of that fundamental theorem of non-commutative algebra which is usually written in the form $eAeB = eC$, where A and B are non-commutative quantities, and C is a series of alternants of A and B. The proof is derived from a property of a matrix called the E-matrix, which involves the structure constants, and one set of the canonical variables, of the parameter group. This property is established independently of the theory of continuous groups. It is proved, further, that every alternant of E-matrices is an E-matrix, and thence is obtained a general expression for the equations of the first parameter group.—A generalisation of the Legendre polynomial: H. **Bateman**.—Isogonal transformation and the diameter transformation: H. L. **Trachtenberg**.

Royal Astronomical Society, January 13.—Prof. H. H. Turner, president, in the chair.—The eclipse of Agathocles in the year —309: Prof. **Newcomb**. The author considered that this eclipse had been identified by Celoria with an eclipse said by Cleomedes to have been total in the Hellespont. Assuming this to be the case, it would be necessary to make a diminution of $1''.5$ in the secular acceleration.—The longitude of the moon's perigee: Mr. **Cowell**.—Magnetic storms and associated sun-spots: Rev. A. L. **Cortie**. Discussing Mr. Maunder's paper (read at the November, 1904, meeting), Father Cortie considered it was still possible to consider sun-spot phenomena and magnetic storms as produced by some common cause, and brought forward evidence from the Stonyhurst observations which he thought conflicted with some of Mr. Maunder's conclusions.—A paper on the same subject: Prof. **Schuster**. From Mr. Maunder's statistics, which Prof. Schuster discussed, it appeared that in some form or other magnetic storms recur at intervals apparently identical with that of the revolution of sun-spot zones. The author was unable, however, to accept Mr. Maunder's explanation of the cause of the storms, which he considered as of terrestrial origin, the earth's diurnal rotation being the real source of the energy. The energy thus drawn away from the earth would tend to diminish its velocity of rotation, but in a million years this diminution would not amount to more than a second a year. Without forming a definite theory on the subject, Prof. Schuster suggested that there is some solar effect, propagated in straight lines, which may increase the electric conductivity of the earth's atmosphere, and thus set a magnetic storm going without supplying its energy. The author concluded that Mr. Maunder had shown the urgent importance of further investigation, but that the facts have become more difficult to understand and explain. After a discussion, followed by a reply from Mr. Maunder, the meeting adjourned, many other papers being taken as read.

PARIS.

Academy of Sciences, January 16.—M. Troost in the chair.—On the generalisation of an elementary theorem of geometry: H. **Poincaré**. The theorem that the sum of the angles of a plane triangle is equal to two right angles is extended to the case of the tetrahedron.—On some theorems relating to algebraic surfaces of linear

connection greater than unity: Émile **Picard**.—On some physical constants of calcium and on calcium amalgam: H. **Moissan** and M. **Chavanne**.—On the β -methyl- ϵ -alkylcyclohexanones and the corresponding alcohols, homologues of menthone and menthol: A. **Haller**. β -Methylcyclohexanone, which can be prepared either by the decomposition of pulegone or from metacresol by Sabatier and Senderens's method, is treated with sodium amide and the alkyl iodide. A mixture of various alkyl derivatives is obtained which up to the present has not been completely separated into its constituents.—On a synthesis of menthone and menthol: A. **Haller** and C. **Martine**. Methylcyclohexanone is treated successively with sodium amide and isopropyl iodide, the mass treated with water, extracted with ether, and the latter solution fractionated in a vacuum. The physical properties of the menthone obtained, as well as those of its oxime, semicarbazone, and other derivatives show that the synthetical is identical with the natural product.—Observations of the Borrelly comet (1904 e) made at the Observatory of Paris with the 30.5 cm. equatorial: G. **Bigourdan**.—On irregular algebraic surfaces: Federigo **Enriques**.—On some points in the theory of numbers: Georges **Rémoudos**.—On equations of the parabolic type: S. **Bernstein**.—On fluorescence: C. **Camichel**. The author has repeated some experiments of J. Burke on fluorescence with some additional precautions. His conclusion, which is opposed to that of Burke, is that the coefficient of absorption of uranium glass for the radiations which it emits during fluorescence is the same whether the fluorescence be excited or not.—Some combinations of samarium chloride with ammonia: C. **Matignon** and R. **Trannoy**. Samarium chloride forms eight different compounds with gaseous ammonia. The range of temperatures between which each of these compounds can exist, together with the heats of dissociation, were determined.—On a colloidal hydrate of iron obtained by electro dialysis and on some of its properties: J. **Tribot** and H. **Chrétien**. A solution of ferric hydrate in ferric chloride was placed in an ordinary Graham dialyser, and the amount of chlorine remaining in the solution determined at different intervals of time, in the first place on simple dialysis, and afterwards when a current of 1 ampere was passed through the solution. In the latter case the chlorine was more quickly and more completely removed; the theory of the two cases is given in detail, and the theoretical and actual results compared.—On an isomeride of trichloracetone: G. **Perrier** and E. **Prost**. Aluminium chloride is allowed to act upon alcohol in carbon bisulphide solution, and chloral is added. A liquid product possessing the composition and molecular weight of trichloracetone is obtained. The reactions, however, are quite different from this latter substance, and

the formula $\begin{array}{c} \text{CCl}_3 \\ | \\ \text{HC} \\ | \\ \text{CH}_2 \end{array} \begin{array}{c} \diagup \\ \diagdown \end{array} \begin{array}{c} \text{O} \\ | \\ \text{O} \end{array}$ is provisionally proposed.—The migra-

tion of the ethylene linkage in unsaturated acyclic acids: E. E. **Blaise** and A. **Luttringer**. The migration of the ethylene linkage has been studied in the case of six alkylacrylic acids and normal $\alpha\beta$ -hexenic acid. It appears to move into the longest chain, giving either an isomeric acid or a γ -lactone.—On the combination of natural leucine with carbamic acid: M. **Hugounenq** and Albert **Morel**.—On a new method of synthesising saturated ketones by the method of catalytic reduction: M. **Darzens**. It is shown that in applying the reaction of Sabatier and Senderens the temperature at which the reduced nickel is reduced is of equal importance with the temperature at which the reduction is carried out. If the nickel is prepared at 245°C . to 250°C ., and the reduction is carried out at 180°C . to 190°C ., unsaturated ketones can be readily reduced to the corresponding saturated compounds without the formation of considerable amounts of secondary alcohols as by-products. The reaction has been applied to mesityl oxide, methylhexanone, and methylheptenone.—Observations on the Borrelly comet (1904 e) made at the Observatory of Besançon: P. **Chofardet**.—Observations of the Borrelly comet (e 1904) made at the Observatory of Algiers with the 31.8 cm. equatorial:

MM. **Rambaud** and **Sy**.—Orogenic sketch of the chains of the Atlas mountains to the north-west of Chott el Hodna: M. **Savornin**.—On the existence and the abnormal tectonic situation of the Eocene deposits in New Caledonia: J. **Deprat** and M. **Piroutet**.—Geological observations collected by the Chari—Lake Chad expedition: H. **Courtet**.—Contribution to the chemical study of the soil, water, and mineral products of the region of Chari and of Lake Chad: Alex. **Hébert**.—On the spring at Hammam Moussa, near Tor, Sinai: R. **Fourtau** and N. **Georgiadès**. The water from this spring approximates to the water at Wiesbaden, containing sodium chloride and the sulphates of lime and magnesia. It has a slightly acid reaction.—Man and the mammoth at the Quaternary period in the soil of the Rue de Rennes, south of Saint-Germain-des-Prés: M. **Capitan**. Excavations in this district have led to the discovery in the Quaternary strata of several roughly executed flint heads and a well preserved tooth of the mammoth. It follows from this and previous discoveries that man, the elephant and the rhinoceros lived in the Seine valley, on the actual spot where Paris now stands.—Chlorophyll assimilation in the absence of oxygen: Jean **Friedel**. It is shown that the presence of oxygen in the atmosphere surrounding the leaf is not indispensable for the process of assimilation.—A gum bearing Stereospermum in Madagascar: Henri **Jumelle**.—The physiological effects of ovariectomy in the goat: P. **Oceanu** and A. **Babes**. Amongst the advantages of this operation in the goat are the disappearance of the characteristic smell of the milk, an increased secretion of the milk, and prolongation of the lacteal period.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 26.

ROYAL SOCIETY, at 4.30.—On the Boring of the Simplon Tunnel, and the Distribution of Temperature that was Encountered: F. Fox.—On the Comparison of the Platinum Scale of Temperature with the Normal Scale at Temperatures between 44° and 190° C., with Notes on Constant Temperatures below the Melting Point of Ice: Prof. M. W. Travers, F.R.S., and A. S. C. Gwyer.—On the Modulus of Torsional Rigidity of Quartz Fibres, and its Temperature Coefficient: Dr. F. Horton.—On a Method of Finding the Conductivity for Heat: Prof. C. Niven, F.R.S.—On the Drift produced in Ions by Electromagnetic Disturbances, and a Theory of Radio-activity: G. W. Walker.—Exterior Ballistics. "Error of the Day" and other Corrections to Naval Range Tables: Prof. G. Forbes, F.R.S.—The Theory of Symmetrical Optical Objectives. Part II.: S. D. Chalmers.—Coloration of Glass by Natural Solar and other Radiations: Sir William Crookes, F.R.S.—Note on the Cause of the Period of Chemical Induction in the Union of Hydrogen and Chlorine: C. H. Burgess and D. L. Chapman.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Fuel Economy in Steam Power Plants: W. H. Booth and J. B. C. Kershaw. (Conclusion of discussion.)

FRIDAY, JANUARY 27.

ROYAL INSTITUTION, at 9.—The Life-History of the Emperor Penguin: Dr. Edward A. Wilson.

PHYSICAL SOCIETY, at 5.—Action of a Magnetic Field on the Discharge through a Gas: Dr. R. S. Willows.—Action of Radium on the Electric Spark: Dr. R. S. Willows and J. Peck.—The Slow Stretch in India-rubber, Glass, and Metal Wires when subjected to a Constant Pull: P. Phillips.—Determination of Young's Modulus for Glass: C. A. Bell.—Some Methods for Studying the Viscosity of Solids: Dr. Boris Weinberg.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Concrete-Making on the Admiralty Harbour Works, Dover: T. L. Matthews.

SATURDAY, JANUARY 28.

MATHEMATICAL ASSOCIATION, at 3.—Models and their Use: E. M. Langley.—The New Geometry: W. H. Wagstaff.—Should Greek be Compulsory for Mathematicians at Cambridge? A. W. Siddons.

ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.30.—On the Occurrence of Gypsum in Essex Soils: T. S. Dymond.—The Bog-Mosses (Sphagnaceae) of Essex, a Contribution to the Flora of the County: F. J. Chittenden.

MONDAY, JANUARY 30.

SOCIETY OF ARTS, at 8.—Reservoir, Stylographic and Fountain Pens: J. P. Maginnis.

INSTITUTE OF ACTUARIES, at 5.—On Staff Pension Funds: G. King.

FARADAY SOCIETY, at 8.—Mass Analyses of Muntz's Metal by Electrolysis, and some Notes on the Electrolytic Properties of this Alloy: J. G. A. Rhodin.—On the Equilibrium between Sodium and Magnesium Sulphates: Dr. R. Beckett Denison.—"Refractory Materials": E. K. Scott.

TUESDAY, JANUARY 31.

ROYAL INSTITUTION, at 5.—The Structure and Life of Animals: Prof. L. C. Miall, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Floating Docks: L. E. Clark.

MINERALOGICAL SOCIETY, at 8.—(1) On Danalite from Cornwall: (2) Crystallographic Characters of Barium-radium Bromide: Prof. H. A. Miers, F.R.S.—On the Regular Growth of Crystals of one Substance upon Those of Another: T. V. Barker.—Apparatus for Determining the Density of Small Grains: K. A. K. Hallows.

WEDNESDAY, FEBRUARY 1.

GEOLOGICAL SOCIETY, at 8.—On the Sporangia-like Organs of *Glossopteris Browniana*, Brongn.: E. A. Newell Arber.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Volumetric Estimation of Reducing Sugars: A. R. Ling and T. Rendle.—The Inversion of Cane Sugar in the presence of Milk Constituents: Hon. Francis Watts.—The Colorimetric Estimation of Salicylic Acid in Food Stuffs: F. T. Harry and W. R. Mummery.

SOCIETY OF ARTS, at 8.—The Navigation of the Nile: Sir William H. Preece, K.C.B.

THURSDAY, FEBRUARY 2.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Compressibility of Gases between One Atmosphere and Half an Atmosphere of Pressure: Lord Rayleigh, O.M., F.R.S.—On the "Blaze Currents" of the Gall Bladder of the Frog: Mrs. A. M. Waller.—The Theory of Photographic Processes; on the Chemical Dynamics of Development: S. E. Sheppard and C. E. K. Mees.—On the Relation between Variation of Atmospheric Pressure in North-East Africa, and the Nile Flood: Capt. H. G. Lyons.—Note on the Determination of the Volume Elasticity of Elastic Solids: Dr. C. Chree, F.R.S.—Theory of the Reflection of Light near the Polarising Angle: R. G. Maclaurin.

ROYAL INSTITUTION, at 5.—Forestry in the British Empire: Prof. W. Schlich.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—The Mechanics of Flour Milling: A. R. Tattersall.

LINNEAN SOCIETY, at 8.—New Chinese Plants from the Neighbourhood of Hong Kong: W. J. Tutcher.—European Marine Species of Isopoda: Dr. H. J. Hansen.

RÖNTGEN SOCIETY, at 8.15.—Some Points in the Construction of a High Frequency Machine: Dr. Clarence A. Wright.

CHEMICAL SOCIETY, at 8.—Studies in the Camphane Series. Part xvi. Camphorylcarbamide and Isomeric Camphorylcarbamides: M. O. Forster and H. E. Fierz.

FRIDAY, FEBRUARY 3.

ROYAL INSTITUTION, at 9.—Blood Pressure in Man: Prof. T. Clifford Allbutt, F.R.S.

GEOLOGISTS' ASSOCIATION, at 7.30.—Address on Modern Methods in the Study of Fossils: the President, Dr. A. Smith Woodward, F.R.S.

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